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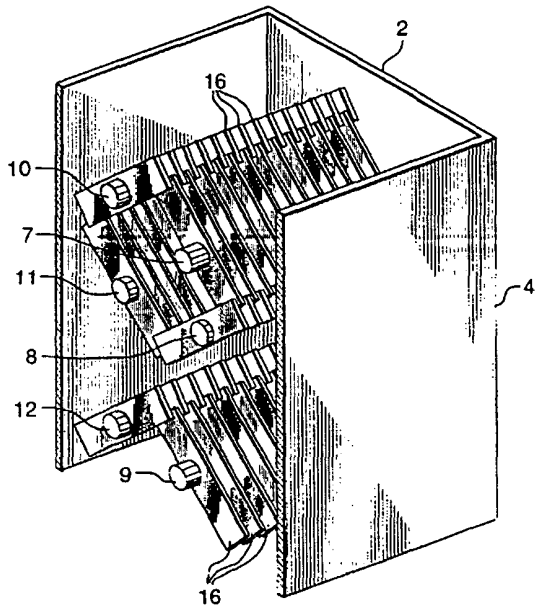
(30) 1995/03/10 (P 195 08 603.1) DE

(54) DECHIQUETEUSE
(54) SHREDDING APPARATUS



(57) The shredder has successive pairs of counter-rotating, intermeshing blades within a housing. The blades are mounted on pairs of shafts, one pair above the other. Preferably, there are three such pairs of shafts, so that the material undergoes three stages of shredding. The shafts preferably are driven by two motors arranged at opposite sides of the housing, one driving four of the shafts, and the other driving two of the shafts, via pulleys which are routed to provide the desired counter-rotation. In each pair of shafts, one shaft rotates at a different speed from the other shaft. The housing comprises frames located one above the other, with one pair of shafts arranged in each frame.

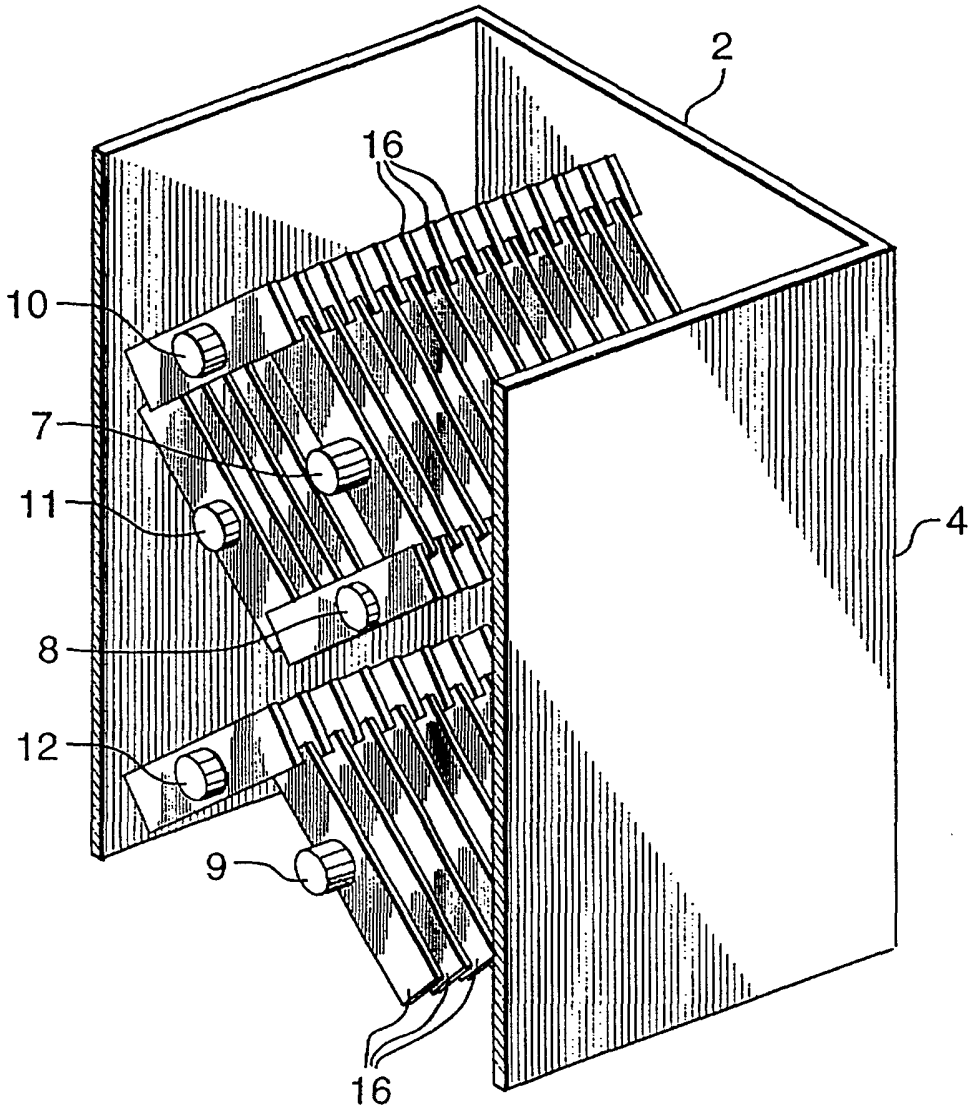


FIG.1

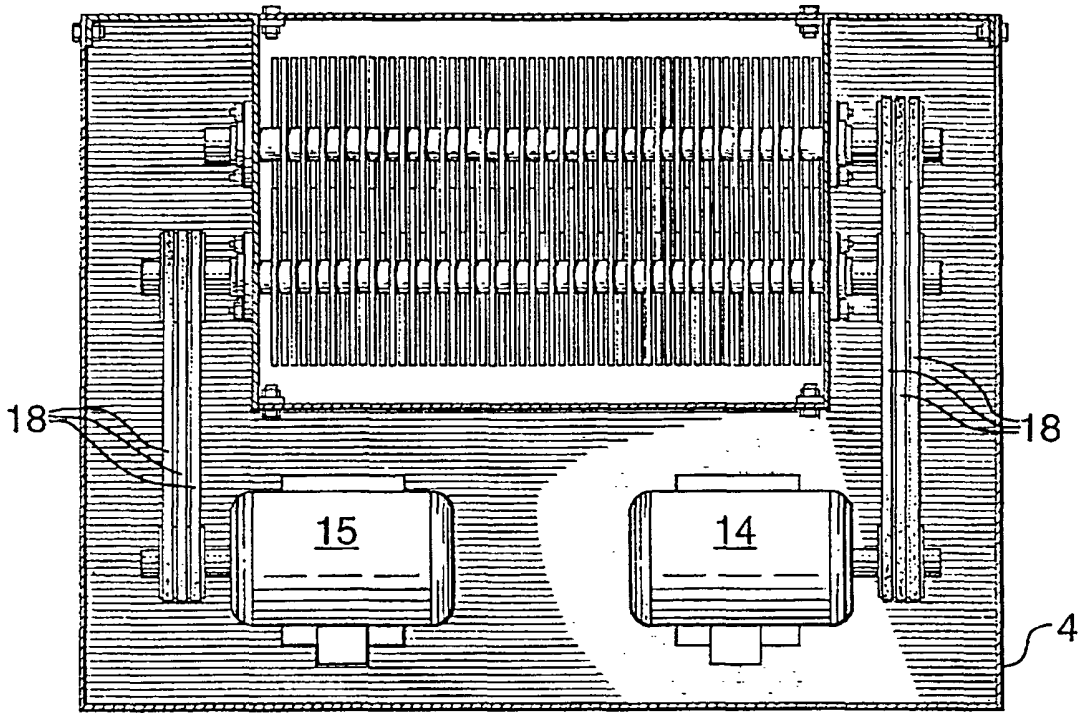


FIG.2

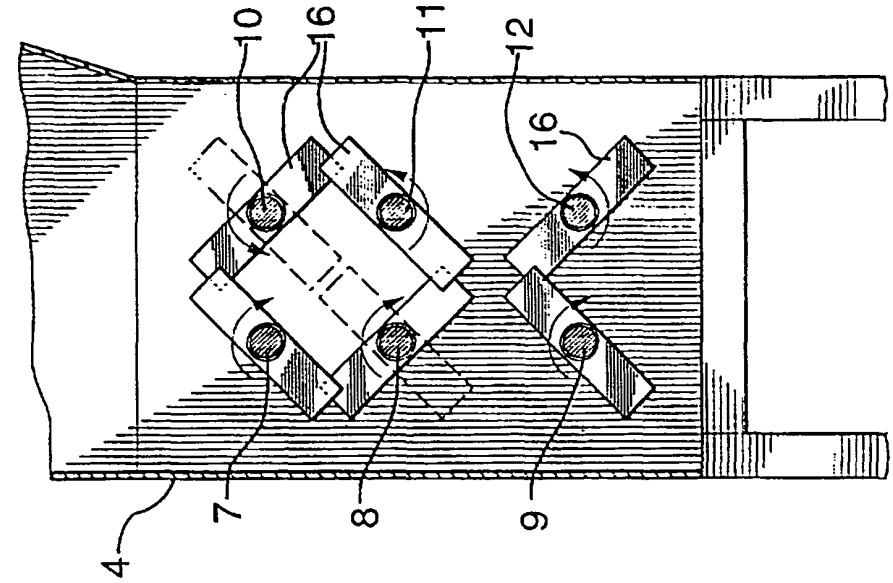


FIG.4

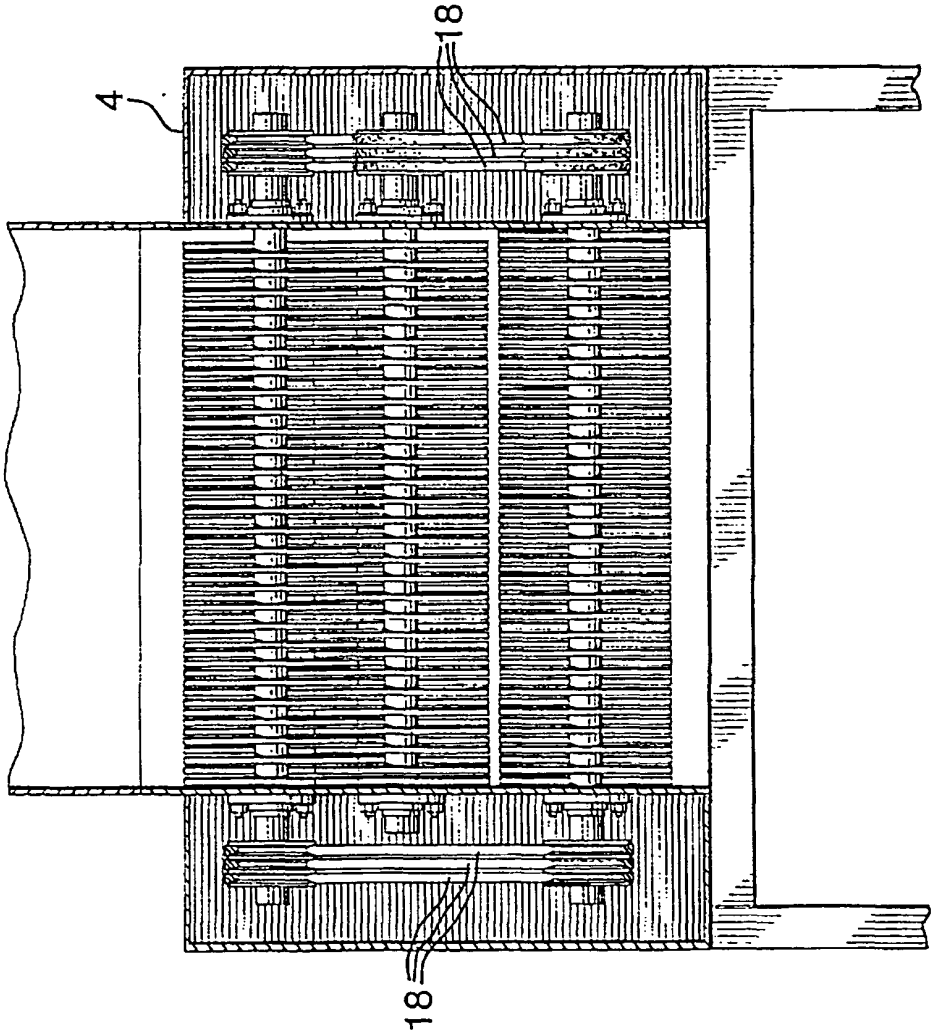


FIG.3

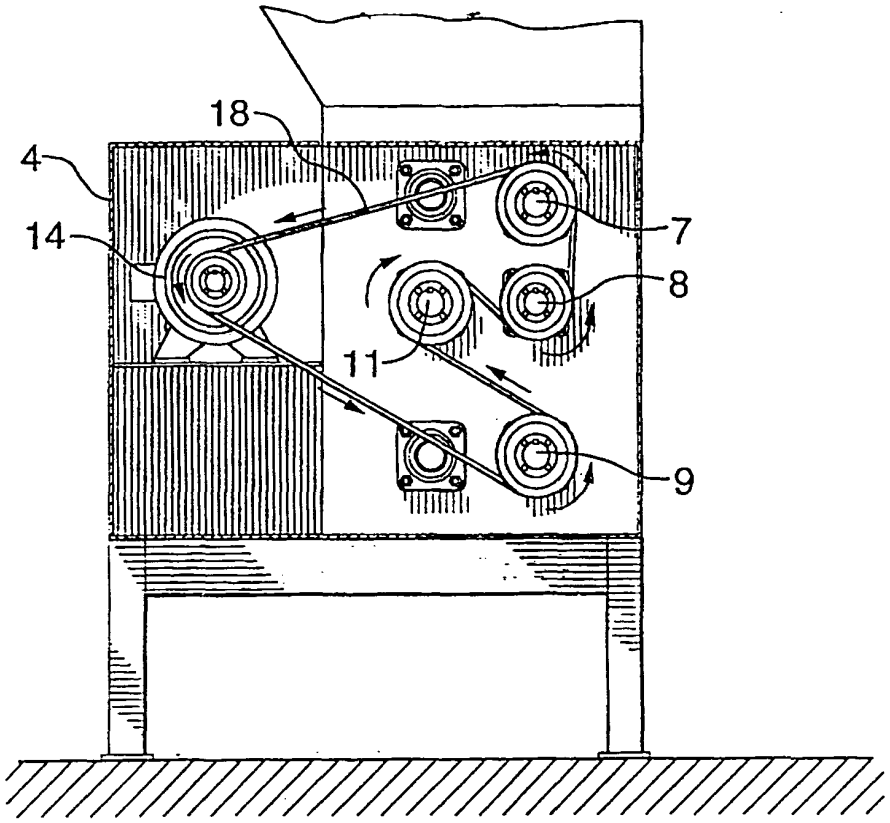


FIG.5

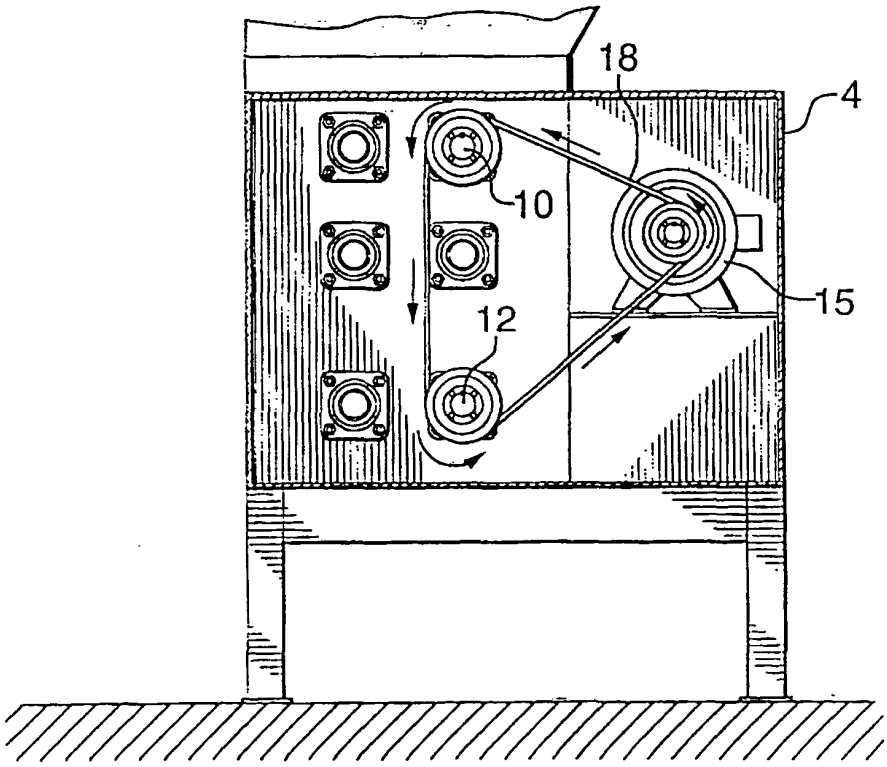


FIG.6

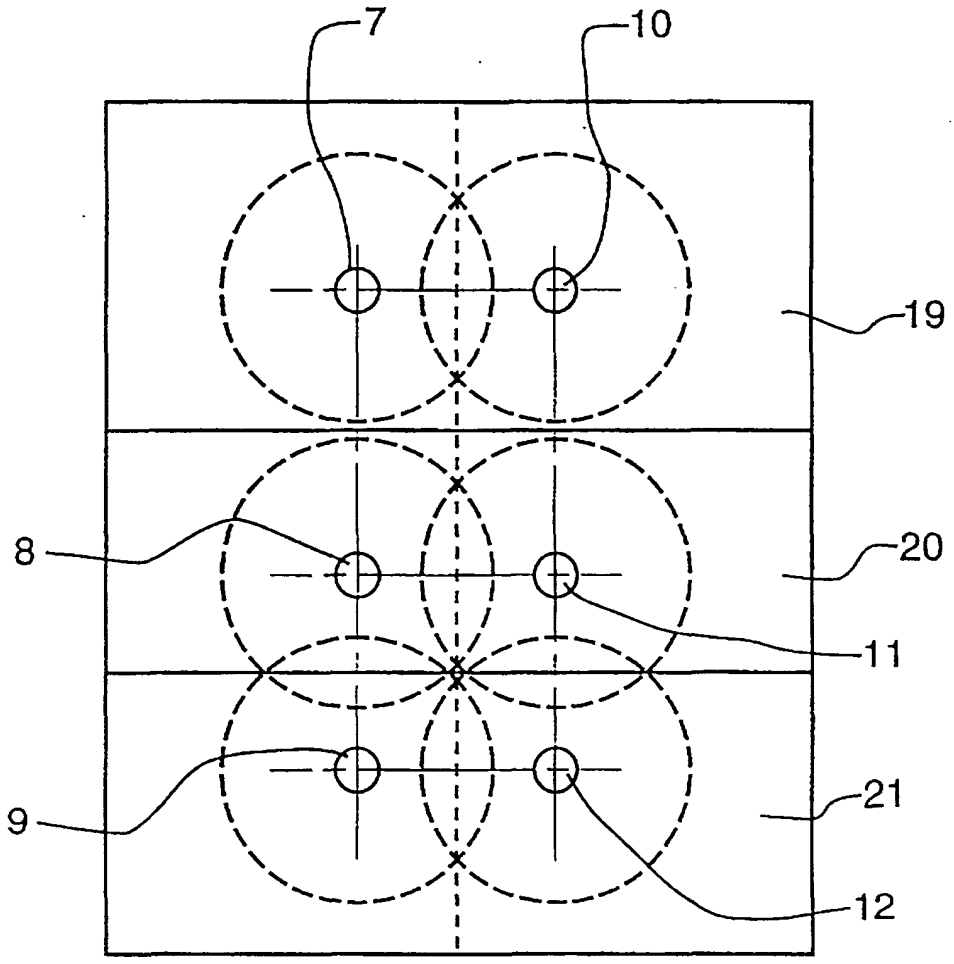


FIG.7

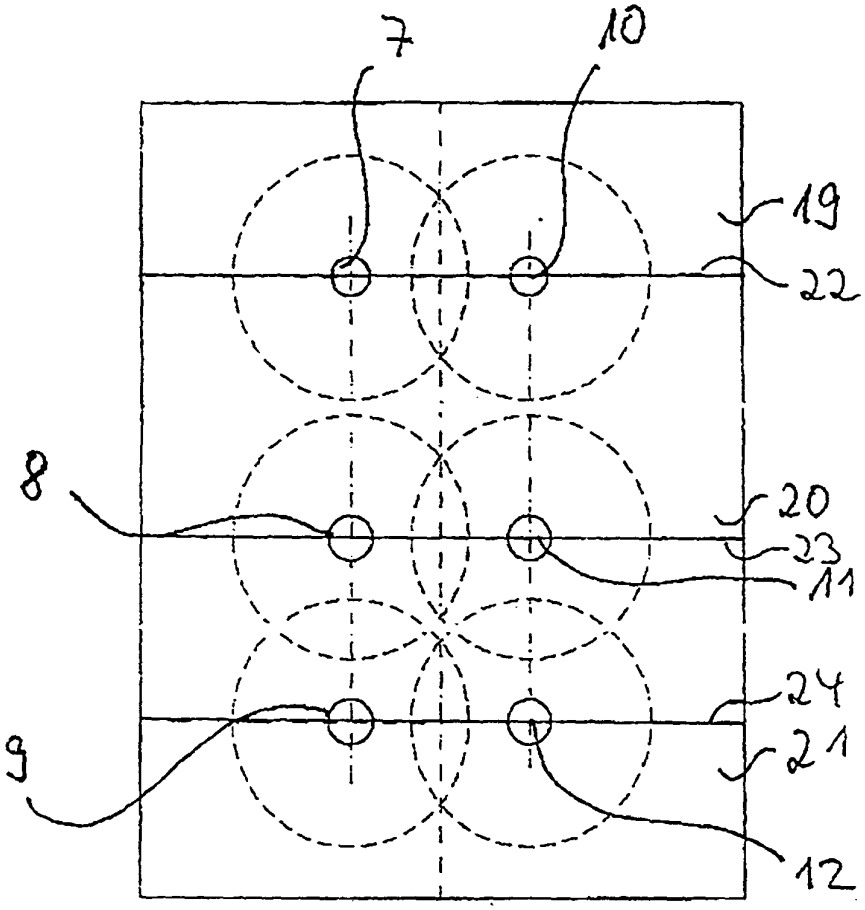


Fig. 8

ABSTRACT

The shredder has successive pairs of counter-rotating, intermeshing blades within a housing. The blades are mounted on pairs of shafts, one pair above the other. Preferably, there are three such pairs of shafts, so that the material undergoes three stages of shredding. The shafts preferably are driven by two motors arranged at opposite sides of the housing, one driving four of the shafts, and the other driving two of the shafts, via pulleys which are routed to provide the desired counter-rotation. In each pair of shafts, one shaft rotates at a different speed from the other shaft. The housing comprises frames located one above the other, with one pair of shafts arranged in each frame.

This invention relates to shredders, and in particular to a shredders of the type where the material to be shredded is pulled downwardly through successive pairs of counter-rotating, intermeshing blades or knives.

The increasing awareness of the need to preserve the quality of the global ecosystem by conserving natural resources has created societal pressures to recycle materials. Because shredding is often the first stage in recycling operations, there is now an increased demand for reliable shredders, particularly those which can be adapted to shred a wide range of materials. Shredding is also increasingly required for applications outside recycling, such as reducing the volume at land-fill sites.

Shredders are of course very well known in the prior art. The inventor has discovered a particular configuration, not known in the prior art to the best of his knowledge, which offers simple and therefore inexpensive construction, and which seems to provide superior performance for a wide range of materials.

It is an object of the invention to provide an improved shredder which is reliable, effective with a wide range of materials, and relatively simple in construction.

In the invention, the material to be shredded is pulled downwardly through successive pairs of counter-rotating, intermeshing blades within a housing. The blades are mounted on pairs of shafts, one pair above the other. Preferably, there are three pairs of shafts, so that the material undergoes three stages of shredding, but the number of pairs could be readily varied.

Material inserted through an inlet at the top of the housing is caught by the blades and pulled down through the shredder, to an outlet at the bottom, the material being shredded into successively smaller pieces by virtue of being sheared apart by the intermeshing blades.

With three pairs of shafts, i.e. six shafts in total, the shafts may be driven by two motors, which preferably are arranged at opposite sides of the housing, one driving four of the shafts, and the other driving two of the shafts, via pulleys which are routed to provide the desired counter-rotation. In each pair of shafts, one shaft rotates at a different speed from the other shaft.

The above features and further features of the invention will be described or will become apparent in the course of the following detailed description.

In order that the invention may be more clearly understood, the preferred embodiment thereof will now be described in detail by way of example, with reference to the accompanying drawing, in which:

Fig. 1 is a perspective view of the shredder with one side panel of the housing cut away;

Fig. 2 is a top view of the shredder;

Fig. 3 is a front view of the shredder;

Fig. 4 is a side view of the shredder, in section, to show the intermeshing of the blades;

Fig. 5 is a first side view of the shredder;

Fig. 6 is a second side view of the shredder;

Fig. 7 is a third embodiment of the housing of the shredder; and

Fig. 8 is a variation of the third embodiment.

Referring to the drawings, Fig. 1 shows a perspective view of the shredder with one side panel **2** of the housing **4** cut away. Within the housing, there are three pairs of shafts, which for greater clarity may be referred to as front upper shaft **7**, the front middle shaft **8**, the front bottom shaft **9**, the rear upper shaft **10**, the rear middle shaft **11**, and the rear bottom shaft **12**. Referring to Figs. 2, 5 and 6, "front" means away from the motors **14** and **15**; i.e. the motors are at the rear of the shredder.

The upper four shafts are 3 inches in diameter; the lower two shafts are 2-1/2 inches in diameter. By the time the material reaches the blades on the bottom two shafts, it has already been substantially reduced in piece size, so a smaller shaft diameter is possible; the blades on the bottom two shafts do not have as much work to do as the upper ones, and do not need to be quite as substantial.

Welded to each shaft are many blades **16**. The blades are of any suitably hard metal. In the preferred embodiment, for example, they are of T100

steel. The blades are flame cut to their elongated rectangular shapes, predrilled to match the applicable shaft diameters, and then welded to the shafts. As seen in Figs. 1 and 4 in particular, the blades intermesh. However, they do not always intermesh in the relative positions as shown in Fig. 4, because there are different rotation speeds, as will be explained shortly.

As can be seen from Fig. 2, there are two motors **14** and **15**, one on each side of the shredder. The motor **14** drives four of the shafts via three belts **18** routed around pulleys on the motor drive shafts and on the six shredder shafts, and the motor **15** similarly drives the other two shafts also via three belts **18**. As seen in Fig. 5, the belts from motor **14** are routed first under the pulleys on the front bottom shaft **9**, then rearwardly and under the pulleys on the rear middle shaft **11**, then downwardly and forwardly under the pulleys on the front middle shaft **8**, then up and over the pulleys on the front upper shaft **7** and back to the motor.

As seen in Fig. 6, the belts from motor **15** are routed first under the pulleys on the rear bottom shaft **12**, then upwardly and over the pulleys on the rear upper shaft **10** and back to the motor.

Thus in each pair of shafts, the blades rotate towards each other and downwardly, to pull the material through the shredder.

Both motors have 6-1/4 inch diameter pulleys. The pulleys on front upper shaft **7**, rear middle shaft **11**, and front bottom shaft **9** are 9-1/4 inches in diameter. The pulleys on the rear upper shaft **10**, front middle shaft **8**, and rear bottom shaft **12** are 8-1/4 inches in diameter. Each motor is operated at approximately the same speed, e.g. 17,500 rpm.

Thus in each pair of shafts (upper, middle and lower), there is one shaft with 8-1/4 inch pulleys, and the other with 9-1/4 inch pulleys. The blades in each pair therefore rotate at different speeds, so that they do not mesh together in the same relative position each time. This is believed to be one factor which accounts for the extremely effective performance of the shredder.

Since the motor **15** drives only two shafts whereas the motor **14** drives four shafts, the motor **15** can be lesser rated. For example, the motor **14** could be 50 H.P., and the motor **15** could be 40 H.P.. Electric motors are

preferred, although obviously the invention is not restricted to any particular type of motor.

A further preferred embodiment of a shredder can be seen in Fig. 7, wherein the housing is structured modularly, in that it consists of three frames **19**, **20** and **21** arranged above each other. The three frames contain the pairs of shafts **7**, **10** and **8**, **11** and **9**, **12** respectively, arranged above each other. The frames with their pairs of shafts each form a module with the bearings and the belt pulley.

Each module can be replaced as a whole unit, so in case of repair or maintenance work, easy handling of the shredders is provided. Also, down time may be shortened by installing a new module, in comparison to the time it would take to repair the module. After having mounted the new module, the shredder can immediately operate again. Then the replaced module can be repaired or maintained without affecting operations.

A variation on the Fig. 7 embodiment is shown in Fig. 8. In this variation, the frames or housing sections separate from the other in horizontal planes **22**, **23**, and **24** corresponding to the planes of the shafts. This structure has the advantage that when a housing section is removed, one pair of shafts is exposed to make it relatively easy to repair or replace a damaged shaft.

The configuration of the shredder in general has been found to be highly effective in shredding a wide range of materials, from automobile body side molding and trim, to running shoes, video tapes, computer keyboards, electronic items generally, toys, glass bottles, etc., etc.. This list is certainly not all-inclusive, since the shredder can be readily adapted to a wide range of materials.

It will be appreciated that the above description relates to the preferred embodiment by way of example only, and that many variations will be obvious to those knowledgeable in the field. Such obvious variations are intended to be within the scope of the invention as defined by the following claims.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A shredder, comprising:

a housing;

a first pair of opposed shafts mounted horizontally in parallel across said housing, spaced apart from each other; and

at least a second pair of opposed shafts mounted horizontally in parallel across said housing, spaced apart from each other, beneath said first pair; each said shaft having a number of elongated blades projecting radially therefrom, the blades from any one shaft intermeshing with at least the blades of the other shaft of that pair; and

at least one motor arranged to rotate said shafts such that in each said pair the shafts are counter-rotating inwardly towards each other and downwardly, such that material to be shredded is pulled downwardly between said shafts, one shaft of each pair being rotated at a different speed from the other shaft of that pair; wherein the housing is of modular construction, said housing comprising at least two frames arranged one above the other, each frame having one of said pairs of opposed shafts.

2. A shredder as recited in claim 1, where there are three said pairs of shafts, one below the other, such that there are six shafts, namely a front upper shaft, a front middle shaft, a front bottom shaft, a rear upper shaft, a rear middle shaft, and a rear bottom shaft.

3. A shredder as recited in claim 2, where there are two said motors, one driving some of said shafts, and the other driving the remaining shafts.

4. A shredder as recited in claim 3, where one of said motors drives four of said shafts, and the other motor drives two of said shafts.

5. A shredder as recited in claim 4, where motors are on opposite sides of said housing.

6. A shredder as recited in claim 4, where said motors each drive said shafts via at least one belt running on pulleys on said shafts and on driveshafts of said motors;

each belt from one said motor being routed from a pulley on the driveshaft, thence under a pulley on the front bottom shaft, then rearwardly and under a pulley on the rear middle shaft, then downwardly and forwardly under a pulley on the front middle shaft, then up and over a pulley on the front upper shaft, and then back to the pulley on the motor; and

each belt from the other said motor being routed from a pulley on the driveshaft, thence under a pulley on the rear bottom shaft, then upwardly and over a pulley on the rear upper shaft, and then back to the motor.

7. A shredder as recited in claim 6, where motors are on opposite sides of said housing.

8. A shredder as recited in claim 6, where said differences in rotation speeds are by virtue of said pulleys on three of said shafts being of different diameter from said pulleys on the other of said shafts.

9. A shredder as recited in claim 8, where motors are on opposite sides of said housing.

10. A shredder as recited in claim 1, wherein at least one of said pair of opposed shafts is mounted in a frame detachably joined with said housing.

11. A shredder as recited in claim 1, where there are at least three said frames, each separating from the other in a horizontal plane corresponding to the plane of said shafts, so that when a frame is removed, one pair of shafts is exposed to make it relatively easy to repair or replace a damaged shaft.

12. A shredder, comprising:

a housing;

a first pair of opposed shafts mounted horizontally in parallel across said housing, spaced apart from each other; and

at least a second pair of opposed shafts mounted horizontally in parallel across said housing, spaced apart from each other, beneath said first pair; each said shaft having a number of elongated blades projecting radially therefrom, the blades from any one shaft intermeshing with at least the blades of the other shaft of that pair; and

at least one motor arranged to rotate said shafts such that in each said pair the shafts are counter-rotating inwardly towards each other and downwardly, such that material to be shredded is pulled downwardly between said shafts, one shaft of each pair being rotated at a different speed from the other shaft of that pair;

where said motors each drive said shafts via at least one belt running on pulleys on said shafts and on driveshafts of said motors;

each belt from one said motor being routed from a pulley on the driveshaft, thence under a pulley on the front bottom shaft, then rearwardly and under a pulley on the rear middle shaft, then downwardly and forwardly under a pulley on the front middle shaft, then up and over a pulley on the front upper shaft, and then back to the pulley on the motor; and

each belt from the other said motor being routed from a pulley on the driveshaft, thence under a pulley on the rear bottom shaft, then upwardly and over a pulley on the rear upper shaft, and then back to the motor.